

What is claimed is:

- 1 A steel wheel comprising:
 - a disc portion; and
 - a rim portion substantially contiguous with said disc portion wherein said wheel is of substantially unitary construction.
- 2 The steel wheel of Claim 1, further comprising a gutter portion which is substantially contiguous with said rim portion.
- 3 The steel wheel of Claim 1, further comprising a well portion, which is substantially contiguous with, said rim portion.
- 4 The steel wheel of Claim 1, further comprising a taper bead-seat portion, which is substantially contiguous with, said rim portion.
- 5 The steel wheel of Claim 4, wherein said taper bead-seat has about a 5° taper.
- 6 The steel wheel of Claim 5, wherein said wheel is of a flat base or semi-drop center type.
- 7 The steel wheel of Claim 1, further comprising a flange portion, which is substantially contiguous with, said rim portion.

- 8 The steel wheel of Claim 1, wherein said disc portion has a center opening therethrough.
- 9 The steel wheel of Claim 1, wherein said disc portion has at least one mounting opening the therethrough.
- 10 The steel wheel of Claim 1, wherein said disc portion has at least one vent opening therethrough.
- 11 The steel wheel of Claim 1, wherein said disc portion has at least one valve opening therethrough.
- 12 The steel wheel of Claim 1, substantially mounted to a vehicle.
- 13 The steel wheel of Claim 1, further comprising a tire substantially mounted to said wheel.
- 14 A method of manufacturing a steel wheel comprising the steps of:
 - forming a disc portion; and
 - forming a rim portion wherein said rim portion is substantially contiguous with said disc portion and wherein said wheel is of substantially unitary construction.
- 15 The method of Claim 14, wherein said wheel is formed from steel stock of substantially uniform thickness.

16 The method of Claim 14, further comprising the step of forming a gutter portion, wherein said gutter portion is substantially contiguous with said rim portion.

17 The method of Claim 14, further comprising the step of forming a well portion, wherein said well portion is substantially contiguous with said rim portion.

18 The method of Claim 14, further comprising the step of forming a flange portion, wherein said flange portion is substantially contiguous with said rim portion.

19 The method of Claim 14, further comprising the step of forming a taper bead-seat portion, wherein said taper bead-seat portion is substantially contiguous with said rim portion.

20 The method of Claim 17, wherein said taper bead-seat is formed with about a 5° taper.

21 The method of Claim 18, wherein said wheel is formed with a flat or semi-drop center.

22 The method of Claim 14, further comprising the step of forming a center opening in said disc portion.

23 The method of Claim 14, further comprising the step of forming at least one mounting opening in said disc portion.

24 The method of Claim 14, further comprising the step of forming at least one vent opening in said disc portion.

25 The method of Claim 14, further comprising the step of forming at least one valve opening in said disc portion.

26 The method of Claim 14, wherein said forming steps comprise at least one of spinning and/or flow forming processes.

27 The method of Claim 14, wherein said method utilizes a spinning machine.

28 A steel wheel of unitary construction produced in accordance with the method of Claim 14.

29 A method of manufacturing a unitary steel wheel rim and disc assembly for 5° taper bead-seat of flat base or semi-drop center rims of the type having an integral disc and rim portion with gutter, well, 5° bead-seat and fixed flange wherein the said method comprises the following steps

- a. Providing a generally circular blank;
- b. The blank is preferably of pre-determined uniform thickness
- c. The blank is preferably with a center hole pierced to a predetermined size.
- d. Preforming the blank to predetermined shape and size, the preform blank is spun and flow formed in a CNC spinning machine, being positioned between a inner mandrel and clamping plate, such

mandrel having a outboard surface of predetermined cylindrical shape confirming to predetermined cylindrical shape and profile of the rim gutter, well and fixed flange.

- e. The spun and flow formed preform to an predetermined cylindrical shape and size is further spun in a CNC spinning machine to reduce thickness consequently to increase the width in the forward direction to an predetermined size while maintaining the predetermined inner diameter wherein the well, bead seat and the fixed flange are formed in the subsequent operations and at the same time further spinning is preformed on the peripheral portion of the cylinder to displace the preform cylindrical peripheral portion in the backward direction, against the outboard surface of the inner mandrel and outboard surface of the outer ring to a predetermined profile and form of well, bead-seat, fixed flange and the final profile and shape of the gutter wall respectively.
- f. The spun preform comprising of finished gutter profile, and cylindrical portion comprising of predetermined shape of the well, bead seat and fixed flange is further spun and flow formed in a spinning machine, the perform being positioned between an outer mandrel and an inner clamping plate, such outer mandrel comprise of a inboard surface which conforms to the final shape of the fixed flange and 5° angle bead-seat, is spun and flow formed against the inner surface of the outer

mandrel by a shaping roller of predetermined shape to form the final shape of the fixed flange and 5° bead seat.

30 The method as claimed in Claim 27 wherein spin forming the peripheral and inner portion of the blank by engaging the same with a forming roller so as to obtain controlled thickness reduction and shape in the peripheral and inner portion of the blank.

31 The method as claimed in Claim 27 wherein the material is displaced in the backward direction during spinning a portion of the perform peripheral cylindrical portion against the outboard surface of an outwardly positioned roll to form the final shape of the rim gutter.

32 The method as claimed in Claim 27 wherein spin forming an section of the blank peripheral portion by engaging the same with a forming roller to form the final shape of the well base shape and dimension and at least a portion of the bead seat.

33 The method as claimed in Claim 27 wherein spin forming the bead seat portion of the blank outboard section against the shaping surface of the outer mandrel to form the final shape of bead seat and fixed flange.

- 34 The method as claimed in Claim 27, wherein: said first-named spin forming step consists a plurality of passes of the forming roller.
- 35 The method as claimed in Claim 27 wherein after first step of spinning operation bolt holes are pierced in a conventional press.
- 36 The method as claimed in Claim 27 wherein after piercing the bolt holes, vent holes are pierced in a conventional press
- 37 The method as claimed in Claim 27 wherein said step (a) consists the step of providing a disc blank of substantially uniform thickness of low carbon steel or HSLA steel composition.
- 38 The method as claimed in Claim 27 wherein a butt-welded hoop of predetermined diameter, width and thickness can also be used instead of a blank.
- 39 The method as claimed in Claim 36 wherein the butt-welded hoop of predetermined diameter, width and thickness can also be used to manufacture the rim part alone.
- 40 Apparatus for manufacturing a integral steel wheel rim and disc assembly for 5° taper bead-seat of flat base or semi-drop center rims of the type having an integral disc and rim portion

with gutter, well-base, bead-seat and fixed flange wherein the said method comprises means for providing a generally circular blank means for forming the blank to of predetermined uniform thickness the blank is preferably with a center hole pierced to a predetermined size, the blank is pre-formed in a conventional press, the pre-form blank further spun in a spinning machine, being positioned between an mandrel having a surface which conforms to the final shape of the rim gutter, well, fixed flange and the clamping plate, the blank peripheral and inner portions is spun and flow formed against the surface of the inner or outer mandrel to form the final shapes of the rim gutter, well and the inboard bead seat and flange.

41 Apparatus for manufacturing a integral steel wheel rim and disc assembly for 5° taper bead-seat of flat base or semi-drop center rims for a vehicle having an integral disc and rim portion with gutter, well base, bead-seat and fixed flange manufactured by the process claimed in claim 1.

42 A integral steel wheel rim and disc assembly for 5° taper bead-seat of flat base or semi-drop center rims for a vehicle having an integral disc and rim portion with gutter, well-base, bead-seat and fixed flange wherein when spin forming machine is programmed to form different shapes.

43 A method of manufacturing a integral steel wheel rim and disc assembly for 5° taper bead-seat of flat base or semi-drop center rims for a vehicle having an integral disc and rim portion with gutter, well-base, bead-seat and fixed flange as

described in the description of complete specification and as illustrated by way of drawings accompanying the complete specification.

44 A integral steel wheel rim and disc assembly for 5° taper bead-seat of flat base or semi-drop center rims for a vehicle having an integral disc and rim portion with gutter, well-base, bead-seat and fixed flange as described in the description of complete specification and as illustrated by way of drawings accompanying the complete specification.

45 An apparatus for manufacturing from a steel blank a steel wheel of substantially unitary construction comprising a disc portion and a rim portion, said apparatus comprising:

- a. a frame;
- b. a rotating component which is substantially rotatably affixed to said frame and which rotates said blank;
- c. a clamping component which maintains said steel blank in a substantially fixed position relative to said rotating component; and
- d. a forming component, wherein said forming component substantially forms said disc and rim portions into said steel wheel of unitary construction from said steel blank.

46 The apparatus of claim 45, wherein, said forming component forms a well into said rim portion of said unitary wheel.

47 The apparatus of claim 45, wherein, said forming component forms a gutter into said rim portion of said unitary wheel.

48 The apparatus of claim 45, wherein, said forming component forms a tire bead seat into said rim portion of said unitary wheel.

49 The apparatus of claim 48, wherein, said forming component forms a tire seat bead having approximately a 5° angle.

50 The apparatus of claim 45, wherein, said forming component forms a flange into said rim portion of said unitary wheel.

51 The apparatus of claim 45, wherein, said forming component forms a unitary wheel having a flat or semi-drop center rim.